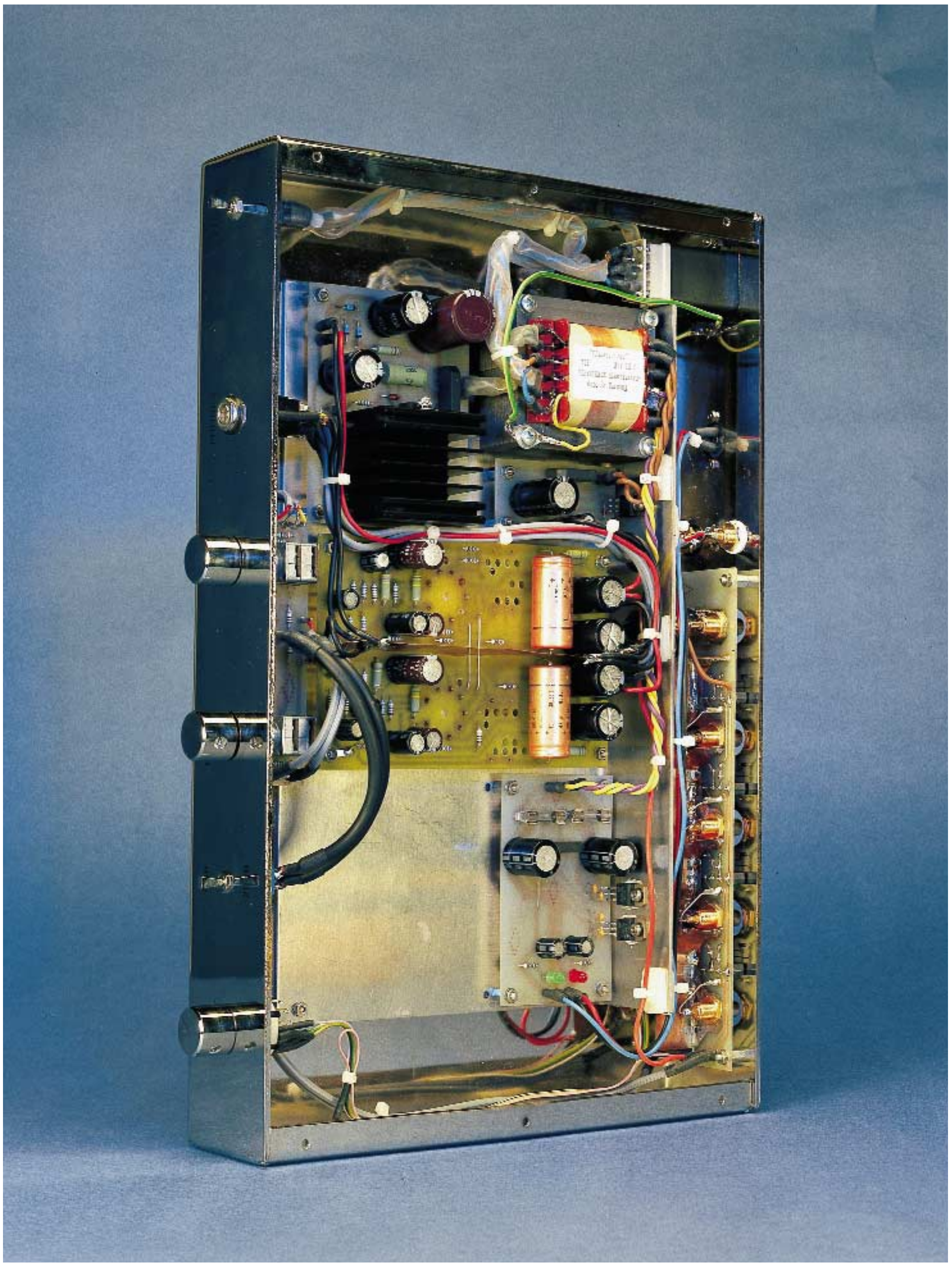
Valve Preamplifier (2)

Construction, first part

Design by G. Haas

You should use only the best components to build a high-end amplifier, if you want to achieve and maintain the specified performance figures.



It is also important that you observe the suggestions given in the text and the components lists, and avoid using inferior-quality ‘equivalent’ types. All printed circuit boards sup-

Please Note, corrections to part I

The dashed connection between R9 and the anode of valve V1b is not an optional wire link. As indicated by the PCB component mounting plan, resistor R9 may be fitted in one of two positions marked R9 and R9*. In pentode mode (default), the resistor is fitted in position R9, i.e., connecting the suppressor grid (g2) to the +324 V anode voltage. This configuration is shown in the circuit diagram, Figure 5. The dashed connection has no meaning.
The quasi-pentode configuration requires the resistor to be fitted in position R9*, i.e., between the suppressor grid and the anode.

Figure 6 does not show two back-emf suppression diodes across the relay coils. These diodes are however present on the board, as well as included in the parts list.

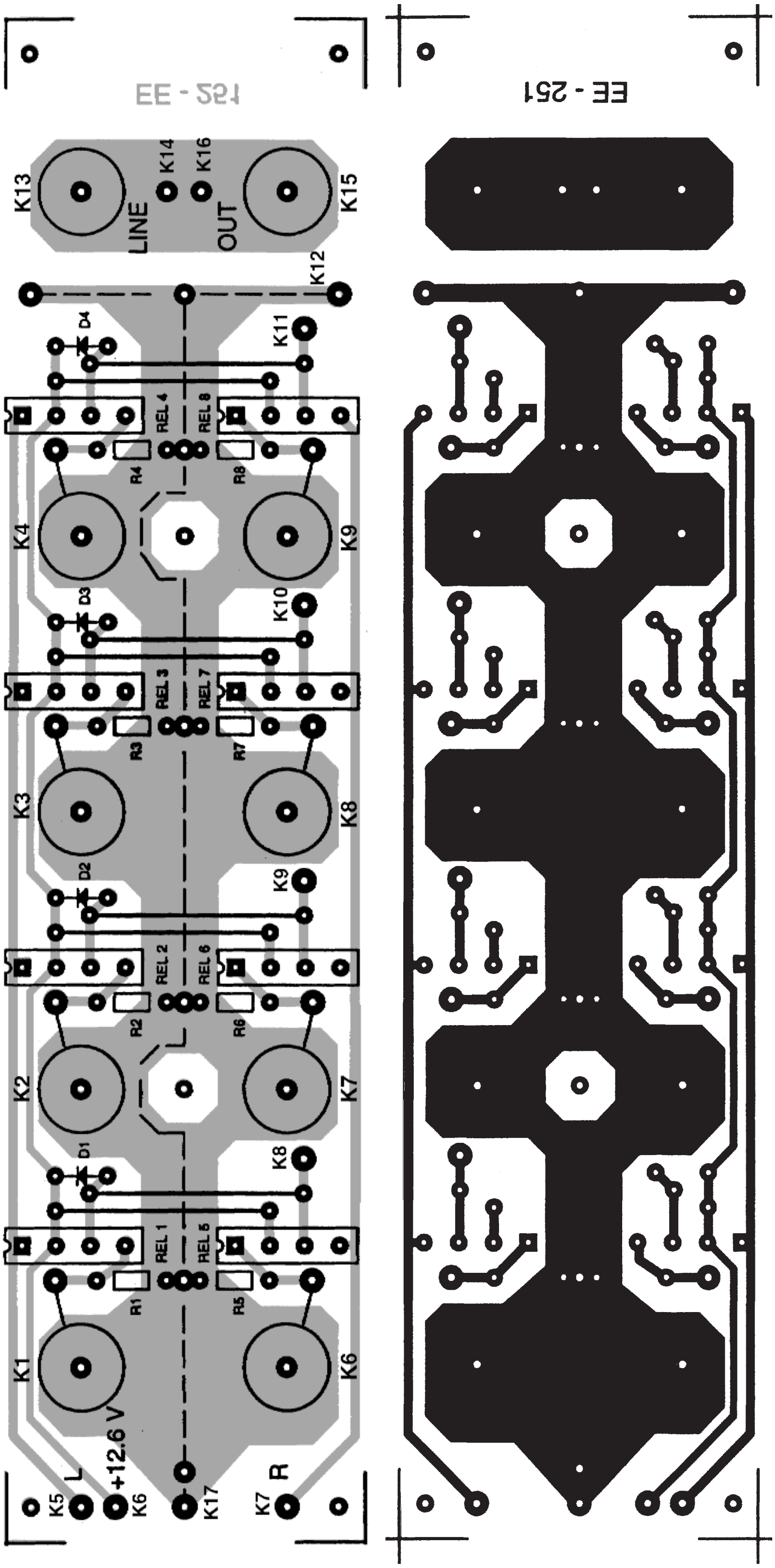
In Figure 7, R10 should be 390 kΩ (not 100 kΩ), and C6 should be 220 μF (not 1000μF).

COMPONENTS LIST

Input Board

Resistors:
R1-R8 = 100kΩ
Rx = see text
Re1-Re8 = SIL reed relay, 12V, 1 make contact

Miscellaneous:
K1-K9 = cinch sockets, chassis mount
Two cinch sockets, chassis mount, for recorder outputs
S1 = rotary switch, 1 pole, 4 contacts, break before make
Solder pins
Copper foil



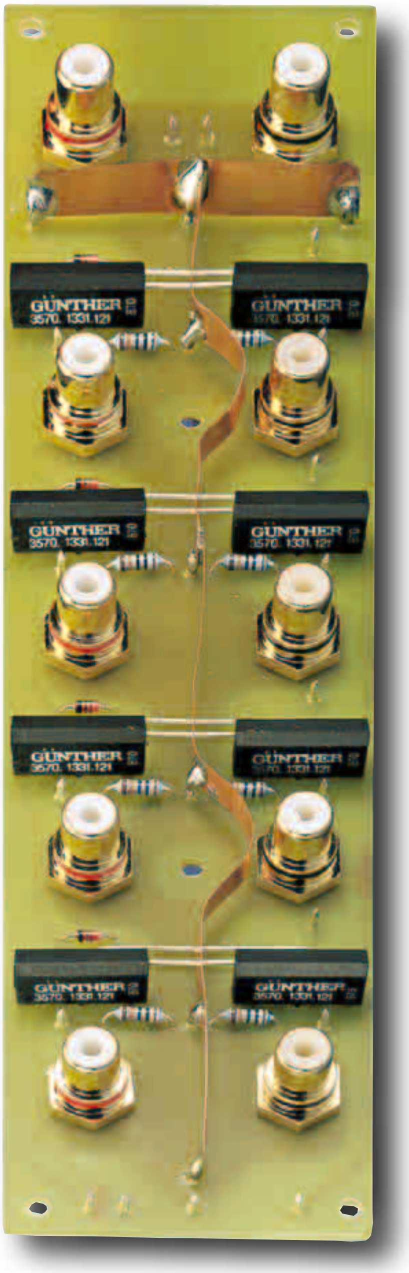
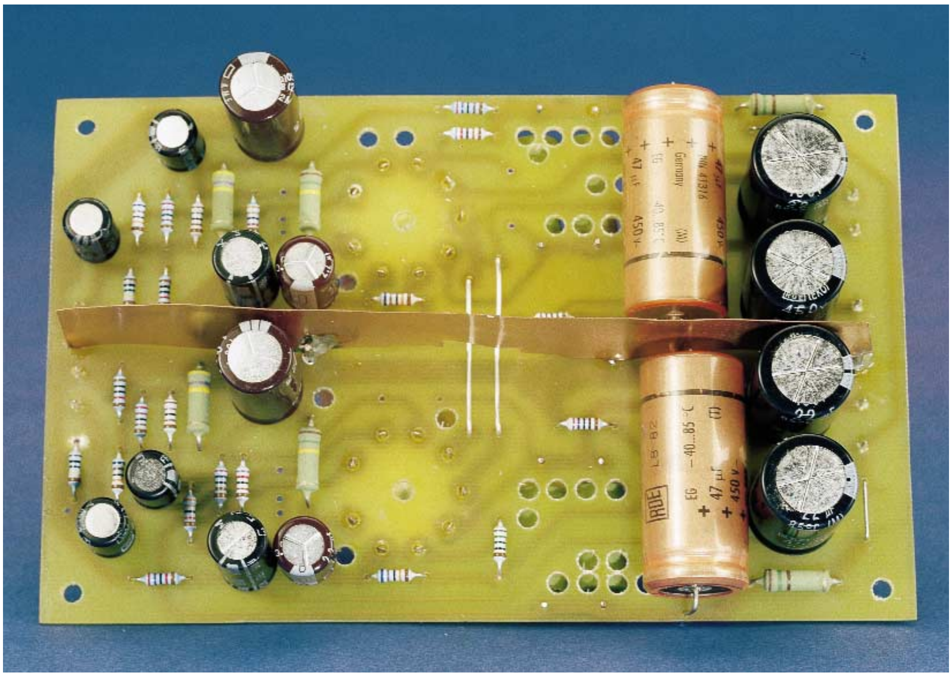


Figure 1. Relay board: printed circuit board track layout, component layout and photograph.



COMPONENTS LIST

Amplifier Board

(one channel)

Resistors:

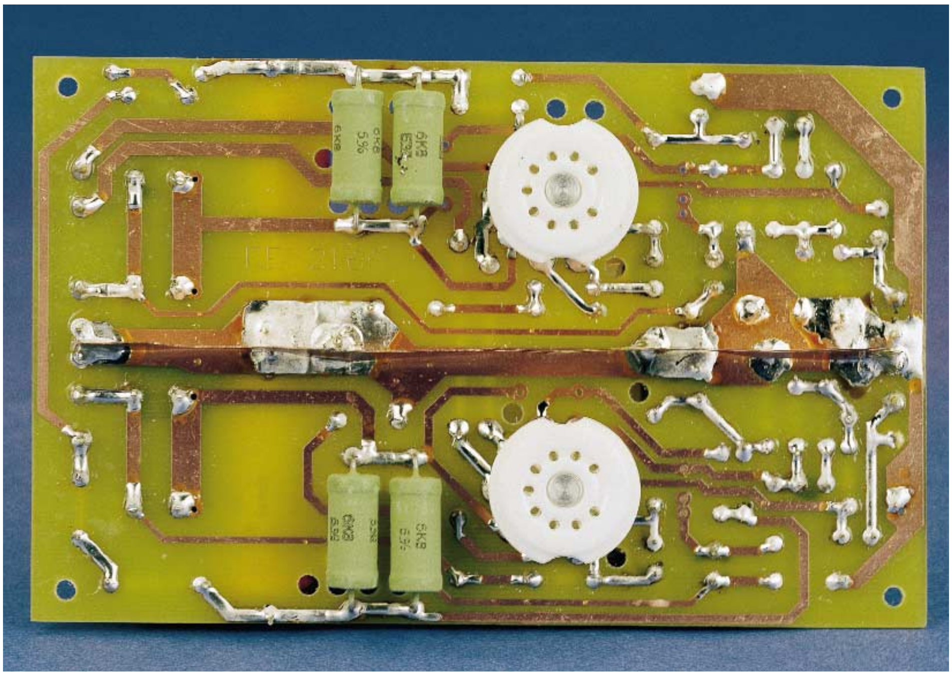
R1 = 680kΩ
R2 = 1kΩ8
R3 = 10kΩ
R4 = 33kΩ
R5 = 2kΩ2
R6 = 150kΩ, 2W
R7 = 470kΩ, 2W
R8 = 2kΩ7
R9 = 8kΩ2
R10 = 680kΩ
R11 = 150Ω
R12 = 270Ω
R13 = 27kΩ
R14 = 150Ω, 2W
R15,R16 = 6kΩ8, 4.5W

Capacitors:

C1 = 1µF 63V, 5mm raster
C2 = 10µF 400V, 5mm raster
C3 = 47µF 40V, 5mm raster
C4 = 2µF2 400V, 5mm raster
C5 = 220µF 40V, 5mm raster
C6 = 47µF 450V, size 18.5x41mm
C7,C8 = 22µF 400V, 7.5mm raster
C9 = see text

Miscellaneous:

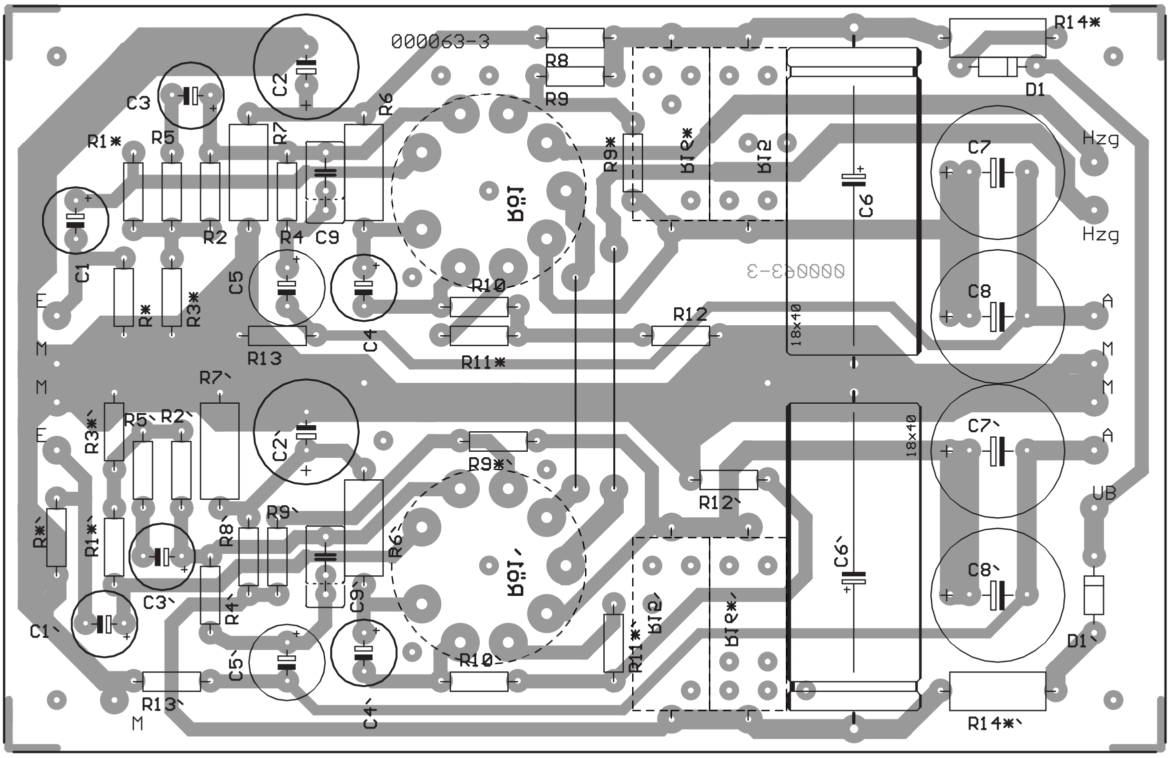
D1 = see text
V1 (Rö1) = ECL86
1 ceramic 'Noval' (9-pin) socket, PCB mount
Copper foil
Solder pins



plied by Experience Electronics for this project are made using fibreglass-reinforced epoxy with a 70-µm copper lamination. All resistors in the components list are 1-percent tolerance, 0.7-W metal film types, unless otherwise indicated, with a lead spacing of 10 mm. The 2-W and 4.5-W resistors are metal oxide types with a tolerance of 5 percent, and have lead spacings of 15 mm and 25 mm respectively. The gold-plated Cinch sockets, as well as the potentiometers, should of course be very high quality.

Before we discuss the construction of the circuit boards, a few words about the enclosure are in order. Even the best electronics, no matter how clever the design may be, is of no use if it is not housed in a suitable enclosure. With valve amplifiers in particular, given their high working voltages, electrical safety is a primary consideration! A metal enclosure, connected to the protective earth lead, provides both safety and screening. If the enclosure also has an attractive appearance, there will be nothing to disturb your listening pleasure.

All circuit modules are housed in an aluminium enclosure. The advantage of aluminium is that it is non-magnetic, so that it avoids magnetic distortions. In addition, it has very good design properties. The enclosure used here has rivitless joints, and the surface is polished and covered by bright nickel plating. Nickel has a warm tone, in contrast to the bluish tone of chrome, and this optically reinforces the 'flair' of a valve amplifier. In order to avoid having an



excessive number of screws visible on the top surface of the enclosure, a mounting plate is used to fit all of the electronics. This plate is then screwed to the chassis using eight bright-nickel-plated Phillips screws. In this way, you can produce a visually attractive piece of equipment.

Board stuffing

Now you can start with stuffing the boards. Start with the relay board, as shown in **Figure 1**. The Cinch sockets are screwed to the

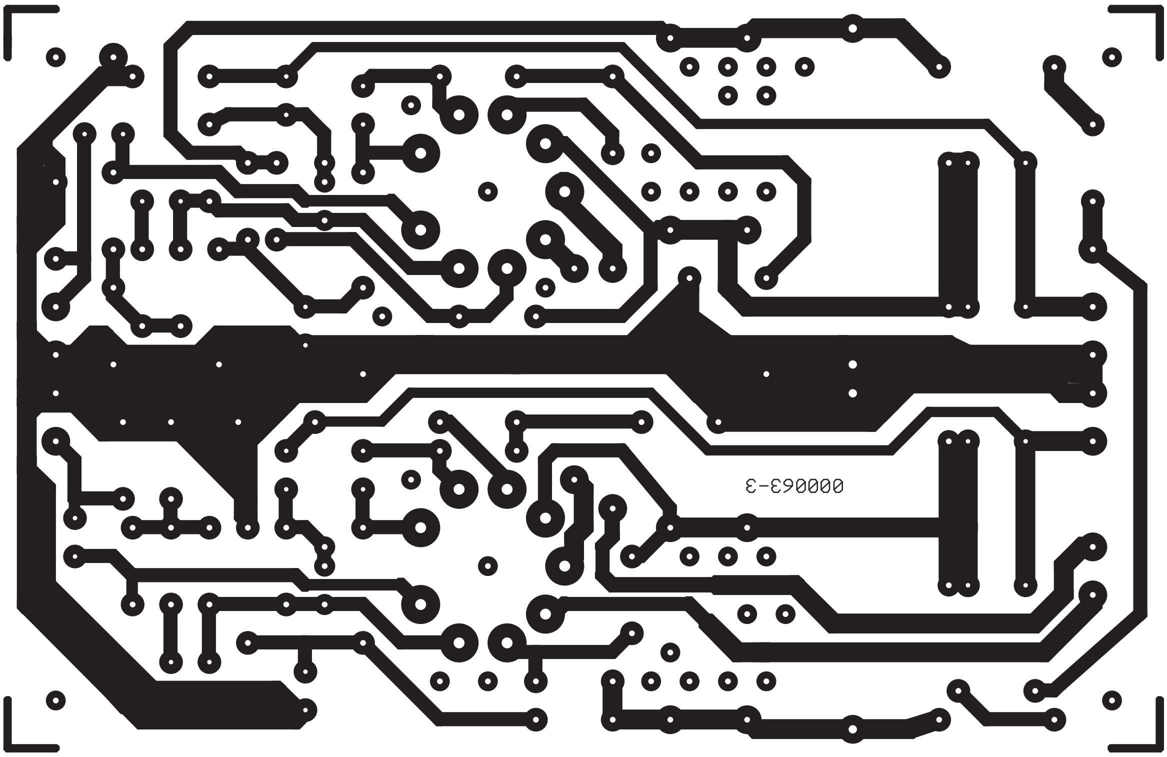


Figure 2. The amplifier board is laid out symmetrically, with the two valves in the middle.

board. You must first tin the tracks at the points of contact, to assure good connections. Apply a drop of solder to each fastening nut to secure it. This guarantees long-term, reliable earth connections. If there is contact resistance in the earth connection at this location, interference is an unavoidable consequence. The photograph shows the construction of the circuit board and the placement of the components. Strips of 0.15-mm thick copper foil are soldered between the sockets. These provide screening on both sides, and between the two channels. In this regard, we can remark that in many modern pieces of equipment, you will find pairs of Cinch sockets in plastic modules that can be screwed to the rear panel of the enclosure, with pins that can be soldered directly to the circuit board. These may be less costly for the manufacturer, and they are easy to mount, but using such modules here will impair the channel separation of the entire device, due to the close spacing of the sockets and the lack of screening.

Since soldering the nuts requires a lot of heat, this should be done first, before any other components are fitted. After this, you can insert the resistors, diodes, relays and solder posts.

The main circuit board with the amplifier, as shown in **Figure 2**, is laid out so that it can be used for other applications by adding or omitting components. Use a wire bridge in place of zener diode D1, which is marked with a star on the circuit board. This diode is only used as an option for other applications, in which the amplifier circuit is operated from a higher supply voltage. The good qualities of a stabilised power supply are retained by the low impedance of the zener diode. A high-valued series resistor would only degrade the quality of the supply voltage.

You should pay attention to certain details when inserting the components in the circuit board. In order to make the valves protrude nicely from the chassis, so that they are readily visible, the valve sockets are mounted on the solder side of the circuit board. This also ensures good heat dissipation. The socket pin assignments are shown in **Figure 3**. Power resistors R15 and R16, which become quite warm, are also mounted on the solder side, separated from the board by a certain amount, in order to improve their heat dissipation. It also doesn't hurt to make a series of ventilation holes in the circuit board in unused areas. This avoids the creation of heat pockets. All other components are mounted on the component side, as usual. The board is mounted to the chassis using suitable spacers.

There is not a lot to say about fitting the

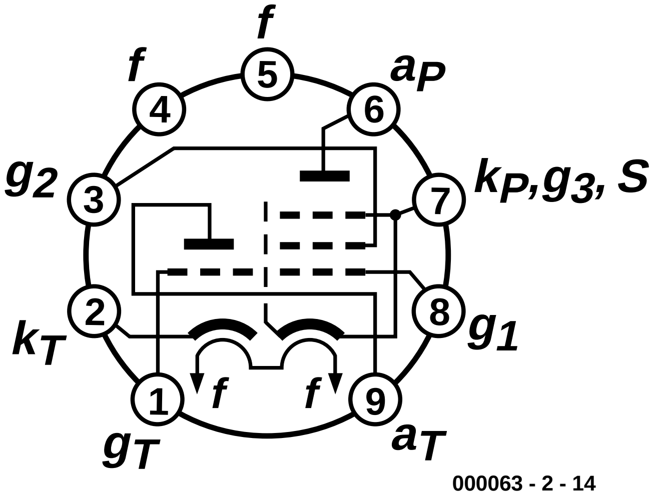


Figure 3. Pin assignments of the ECL86, viewing the pins from the bottom.

K_p	pentode cathode	g_3	pentode suppressor grid
s	internal shield	f	filament
g_T	triode grid	k_T	triode cathode
g_2	pentode screen grid	a_p	pentode anode
g_1	pentode signal grid	a_T	triode anode

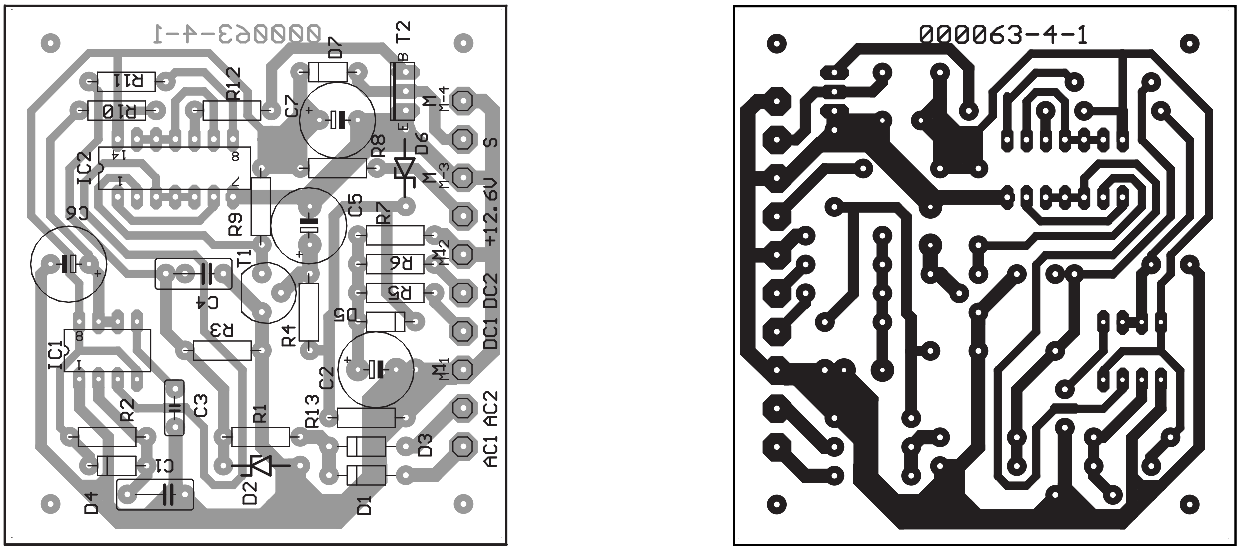


Figure 4. Printed circuit boards for the protective circuitry.

components to the protection circuit board (**Figure 4**). Sockets may be used for the DIL ICs. If you pay attention (as always) to the correct locations and polarisations of all components, everything will be OK.

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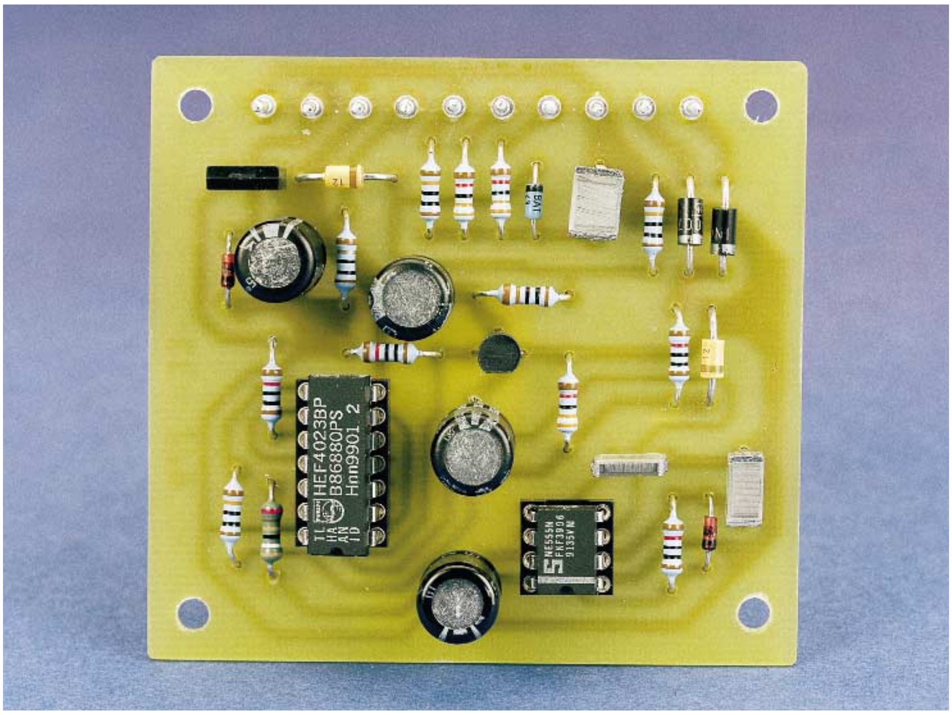
Note:
Kits, PCBs and parts for the Valve Pre-amplifier are available from
Experience Electronics,
Weststrasse 1,
D-8942 Herbrechtingen, Germany.
Tel. (+49) 7324 5318,
fax (+49) 7324 2553.
Email:
experience.electronics@t-online.de



COMPONENTS LIST
Protection Circuit

Resistors:
R1,R2 = 10kΩ
R3 = 33kΩ
R4 = 1kΩ
R5,6 = 33kΩ
R7 = 100kΩ
R8 = 10Ω
R9 = 10kΩ
R10 = 390kΩ
R11 = 100kΩ
R12 = 10kΩ
R13 = 100kΩ

Capacitors:
C1 = 0.22µF MKT, raster 7.5mm
C2 = 0.33µF MKT, raster 7.5mm
C3 = 10nF ceramic, raster 5mm
C4,C5 = 1µF 63V, raster 5mm
C6 = 220µF 40V, raster 5mm
C7 = 47µF 40V, raster 5mm

Semiconductors:
D1,D3 = 1N4007
D2,D6 = zener diode 12 V, 1.3W
D4,D7 = 1N4148
D5 = BAT43
T1 = BC546B
T2 = BD139-16
IC1 = 555
IC2 = 4023

Miscellaneous:
1 off 8-way DIL IC socket, gold-plated contacts
1 off 14-way DIL IC socket, gold-plated contacts
Solder pins